



BUILDING BIODIVERSITY

The Natural Resource
Management Approach

Today Janez Potočnik and Izabella Teixeira are colleagues as Co-Chairs of the International Resource Panel. A decade ago, they became friends as negotiators at the 10th Conference of Parties of the Convention of Biological Diversity in Nagoya, Japan. They have distilled that decade of experience into clear, science-based principles informed by the research of the International Resource Panel.

To the world's efforts to restore and regenerate nature, they add the single-biggest missing piece: natural resource management. The picture that emerges is one of opportunity: for biodiversity-rich nations to be recognized for the value of their natural wealth and be rewarded for maintaining ecosystem services, and for countries with high resource footprints to invest in global natural resource management as an efficient strategy to reduce their indirect pressure on biodiversity to ensure an environmentally secure future.

As policymakers prepare for CBD COP 15, these science-based principles can help them move beyond pledges and commitments, and take action that we can soon see working in the natural world. Sharing lessons from their past and present roles, and based on powerful scientific evidence from the International Resource Panel, the Co-Chairs urge Parties to push for a bold global agreement on biodiversity targets.

Countries must use natural resource management approaches to acknowledge, understand and address the direct and indirect drivers of biodiversity loss for climate, nature and socially just economic and social development.



ACKNOWLEDGMENTS

Authors: Janez Potočnik and Izabella Teixeira

The authors of this piece would like to thank SYSTEMIQ (Sanna O'Connor, Julia Okatz) and the IRP Secretariat (Merlyn van Voore, Hala Razian, Christina Bodouroglou) for their support in the development of this piece. They thank the SUN Institute Environment & Sustainability for its vital in-kind support. For their review and other valuable input, they also thank IRP Panel Members Stefan Brinzeu, Stefanie Hellweg, Jeff Herrick, and Eeva Primmer, SYSTEMIQ (Guido Schmidt-Traub, Rupert Simons, Theo Gott), and Sir Robert Watson.

Recommended citation: IRP (2021). Building Biodiversity: The Natural Resource Management Approach. Potočnik, J., Teixeira, I. A think piece of the International Resource Panel Co-Chairs.

Design and layout: Yi-Ann Chen (IRP Secretariat)

Reproduction: This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. The co-authors would appreciate receiving a copy of any publication that uses this publication as a source. No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the co-authors.

Disclaimer: The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.



BUILDING BIODIVERSITY

THE NATURAL RESOURCE MANAGEMENT APPROACH



Janez Potočnik and Izabella Teixeira
Co-Chairs of the International Resource Panel

0

Executive
Summary

Page 1



1

Biodiversity
supports
humanity in all
its needs, yet we
neglect its value.

Page 5



2

In 2021 we must
seize the political
moment and
focus global
biodiversity
governance on
the drivers of
biodiversity loss.

Page 9



3

To address the
drivers of
biodiversity
decline, we must
take a natural
resource
management
approach.

Page 13



4

Four principles of
natural resource
management can
help countries
effectively
implement
biodiversity
policy.

Page 17



5

Make targets
bold and
implementable
through a
natural resource
management
approach to help
Kunming succeed.

Page 33



EXECUTIVE SUMMARY

Resource management is the link between sustainable prosperity and the survival of the natural world.

Decision makers, whether in government or the corporate sector, operate within an economic framework that does not formally recognize how much we rely on biodiversity, for everything from food and medicine to climate resilience. This means our economic systems are failing to account for the real cost of environmental damage and harmful resource use. **And so far, our efforts to protect and restore nature have overlooked the biggest single factor in biodiversity loss: the world's inefficient and irresponsible use of natural resources.**

The Aichi Targets state that governments and natural resource stakeholders ought to, among other commitments, implement plans for sustainable production and consumption. These targets were intended to keep the impacts of natural resource use well within safe ecological limits. There has

been only very limited success, but we know that it is possible to do more.

Using a natural resource management approach to fulfil this directive in the post-2020 framework means turning the underlying drivers of biodiversity loss, including consumption and production of natural resources, into opportunities for innovation and leadership with the potential to expose misaligned economic incentives and vested interests. We can address the illness, not the symptoms, of biodiversity loss, by promoting natural resource management strategies that enable the active protection, restoration and regeneration of biodiversity to drive sustainable development.

The most ambitious targets and credible implementation plans at Kunming will acknowledge this.

Based on natural resource management approaches, decision makers can apply four principles to turning biodiversity loss into biodiversity value:

Know your true impact

Every sector and every consumer must understand why and how they have an impact on nature – where the materials come from and how each step in a product's life cycle affects biodiversity. Producing, using and re-using, and finally disposing of products in resource-efficient and circular ways can reduce their impact on biodiversity or even have a net positive effect. With enough transparency about impact, decision makers can design policies that incentivize demand for these biodiversity-positive products.

Plan together

Policymakers can engage with businesses, diverse government departments and local leaders, and consult with scientists, to map the overlapping uses of natural resources, in the ocean and on land. It is the combination of local and scientific knowledge that will allow "business as usual" to be replaced with the innovative, integrated policies that are essential to simultaneously meet biodiversity, climate, socio-economic and infrastructure needs.

Grow with nature

Policies that incentivize a circular bioeconomy founded on nature-based solutions will support a global economy that leverages natural ecosystem services to improve quality of life while reducing and, where possible, reversing biodiversity loss.

Value nature

To value natural capital is not to detract from nature's intrinsic worth. Instead, it enables the economic system to recognize nature's benefits and allow investment, such as payments for ecosystem services. This valuation of natural capital will require clear international standards and careful regulation.

In 2020, 83 countries committed to the "Leaders Pledge for Nature", promising to reverse biodiversity loss by 2030 for sustainable development. Although far from universal, it demonstrated a powerful example of the new global momentum towards addressing biodiversity loss. **The focus will be on countries to honour these commitments in Kunming, through science-based targets and implementation strategies. We call on leaders to focus their strategies on natural resource management approaches – the missing link in policymaking that can incentivize transformational change.**



©Photo: Visoot Uthairam / Flickr

Box 1

What are natural resources? A note on terminology

This piece speaks about “natural resources” and “principles of natural resource management”. We describe below some of our definitions of these concepts.

- When speaking about “**natural resources**”, we use the International Resource Panel definition, which refers to metals, minerals, fossil fuels, biomass, water and land. These resources can be tracked as flows through the economy: from extraction, through processing and consumption, to point of reuse or discarding at end-of-life.
- When referring to “**natural resource management**” and its approaches, we refer to strategies and tools to secure the sustainable use of these “natural resources”.
- When speaking about “**principles**”, we refer to evidence-based elements of successful natural resource management approaches to policymaking.
- When speaking about “**assets**”, we mean something that provides societal value by enabling better functions, such as biodiversity preventing erosion and improving the quality and resilience of crops.
- When referring to “**value chains**”, we refer to all stages in a product’s life, from supply of raw materials through to disposal after use, and encompasses the activities linked to value creation such as business models, investments and regulation (UNEP 2021a, p.23).
- Finally, when describing “**nature-based solutions**”, we refer to actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (International Union for Conservation of Nature [IUCN]). We do not refer to all anthropogenic methods for producing biomass, such as mono-cropping, but rather practices which seek to mimic the same ecosystem services that nature provides.

In the piece you will see that these definitions are applied to explain how key “principles” of tracking, systemically planning, deliberately encouraging circularity and valuing natural resource flows, i.e. “natural resource management”, can unlock the value of biodiversity for socio-economic development.



1.

BIODIVERSITY SUPPORTS HUMANITY IN ALL ITS NEEDS, YET WE NEGLECT ITS VALUE.

Biodiversity is the diversity within species, between species and of ecosystems. It offers our world untold richness. It delivers crucial services for human health and societal resilience, while also providing clear intrinsic value¹ (Rea 2017). The advantages of a biodiverse planet are widespread and varied, from reducing the likelihood of zoonotic diseases, to mitigating the impacts of flooding. Biodiversity underpins our food systems by aiding crop pollination and promoting healthy soil formation. It boosts ecosystem productivity and resilience, ensuring every resource that humanity relies on from the natural world is amplified and protected from system shocks.

And yet – biodiversity is declining faster than at any time in human history. In less than half a century we have witnessed the disappearance of about half of Earth's forests and one million animal and plant species are threatened with extinction (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES] 2019a). Two-thirds of our marine life

is under threat from plastic pollution and overfishing, and global recorded populations of animals, mammals, birds, fish, amphibians and reptiles have fallen by 68 per cent over the last half century (World Wide Fund for Nature [WWF] 2020).

“

Earth's living systems as a whole are being compromised. And the more humanity exploits nature in unsustainable ways and undermines its contributions to people, the more we undermine our own well-being, security and prosperity.”

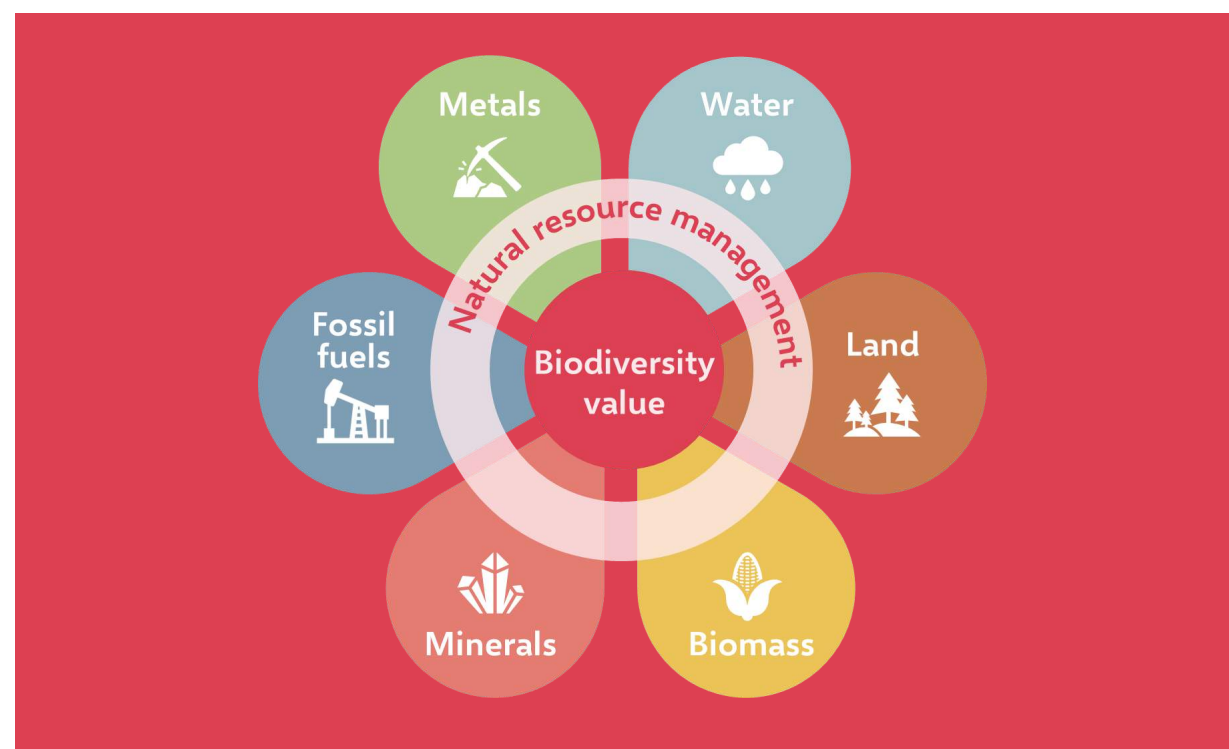
Elizabeth Mrema, Executive Secretary,
UN Convention on Biological Diversity

We know that the primary cause of biodiversity loss is the inefficient production and use of natural resources to provision societies (IRP 2019a). The IRP Global Resources Outlook 2019 found that the extraction and processing of biomass drives over 80 per cent of land-use-related biodiversity loss. Biomass – crops, crop residues, grazed biomass, timber and wild catch of fish – is used for food, material, feedstock and for energy, of which the unsustainable production and consumption of agricultural commodities is a major culprit (IRP 2019a). Three-quarters of the Earth’s surface has been altered by humans, leading to an unprecedented decline of forest and natural spaces (IPBES 2019b). This approach is self-destructive: the food system relies heavily on the ecosystem services provided by biodiversity, such as pollination, healthy soils and clean water

(IRP 2016). Further evidence of this can be found in the IRP Global Resources Outlook (2019a).

These provisioning ecosystem services all depend on healthy, biodiverse, natural environments. Their true value remains unknown, but the costs of ecosystem degradation are beginning to stack up. The Food and Agriculture Organization of the United Nations (FAO) estimates that, globally, \$240–560 billion worth of crops rely on honey bee pollination (FAO 2018), yet in the USA over the past 60 years honey bee hives have declined by 60 per cent (van Engelsdorp 2008). Mangrove forests help avoid an estimated \$80 billion each year globally in coastal flooding damage (Global Commission on Adaptation 2019), yet they continue to be cleared for better sea views, coastal aquaculture and maritime access.

Figure 1: Sustainable resource management nurtures biodiversity value.



We operate in an economy that does not recognize how much we rely on biodiversity, for everything from food and medicine to climate resilience. An estimated 1.2 billion jobs rely on effective management and sustainability of ecosystems (World Business Council on Sustainable Development [WBCSD] 2021) and 70 per cent of people living in poverty depend on natural resources for their livelihoods (Kempf 2018). This inequality is exacerbated along gender lines: 700 million people around the world regularly go hungry (UNEP 2021b), and seven out of ten of them are women and girls (Kempf 2018). Their reliance on natural resources makes impoverished populations even more vulnerable to environmental degradation and climate change (Kempf 2018).

The 2021 Dasgupta Review has found that the value of the stock of natural capital has fallen around 40 per cent per capita in the past 25 years – even as globally produced capital per head has doubled. We have failed to manage natural capital in a manner that maintains resilience and prosperity. Increased extraction of natural capital will now therefore come at the expense of future provision of the services nature provides (Dasgupta 2021; WBCSD 2021).

Nature is a resource keeping each of us alive; but it is degrading rapidly and being shared unfairly. High-income countries, representing one-third of the global population, have material consumption footprints that are 60 per cent higher than middle-income countries, and thirteen times the level of low-income countries (IRP



2019a). While the poor rely on biodiversity and natural resources for their basic survival, it is the wealthier nations whose consumption of these resources lead to the greatest negative environmental impact.

Trends of biodiversity decline risk causing dangerous and irreversible breakdowns of terrestrial, freshwater and ocean ecosystems, threatening the foundations of social and economic provisioning systems upon which billions of people rely. Not to mention the cultural, climate regulating and supporting services also threatened by the breakdowns of ecosystems. The world is already experiencing severe impacts from biodiversity loss, but we are struggling to take the necessary action.

1. Intrinsic value defined as the true value of an asset not determined by market prices. In the case of nature, recognizing that it has value in its own right, independent of human use.

2.

IN 2021 WE MUST SEIZE THE POLITICAL MOMENT AND FOCUS GLOBAL BIODIVERSITY GOVERNANCE ON THE DRIVERS OF BIODIVERSITY LOSS.

This year, the Convention on Biological Diversity (CBD) is embarking upon a new official cycle for target setting, known as the Post-2020 Global Biodiversity Framework. This is part of the “super year” for environmental management as science highlights the urgency of this decade for reaching the Sustainable Development Goals (SDGs) and managing planetary and climatic tipping points for staying within a safe operating space for humanity.

The Post-2020 Global Biodiversity Framework is a crucial opportunity for global environmental leaders. It can enable them to pursue ambitious, tangible and urgent action(s) to transform the underlying drivers of biodiversity loss. It also provides the opportunity to systematically incorporate biodiversity into the policies and incentives that govern our socio-economic development.

Kunming is our chance to frame biodiversity governance as an opportunity for all nations, and especially for biodiversity-rich regions. These regions have the potential to become leaders in innovation and commerce as hubs for nature-based solutions and a global circular bioeconomy. Countries with the highest resource-use footprint must also take heed or risk the resilience of their supply chains, in addition to more global implications for food security, and human health. This is why all countries have an interest in pushing for an ambitious agreement based on natural resource management approaches.

However, we have been here before. Over the past 20 years, efforts have been made to address the loss of biodiversity, notably, through the [Strategic Plan for Biodiversity 2011–2020](#) (and its related [Aichi Targets](#)), and the [2030 Agenda for Sustainable Development](#).

In our roles as negotiators, we first met as the Aichi Targets were adopted in Nagoya in 2010. We observed that the Targets were created with the best intentions and therefore had our political support. However, in the end the Strategic Plan lacked a clear strategy for implementation to specifically address the underlying dynamics driving biodiversity loss. Consequently, the Aichi Targets largely failed to be met (Secretariat of the Convention on Biological Diversity 2020).

While biodiversity provides essential services to society, global policy development or national implementation strategies have not sufficiently accounted for the actual drivers of biodiversity loss. The Aichi Targets included strategic

objectives of *addressing the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society*, including a target for “business and stakeholders at all levels to have taken steps to achieve or have implemented plans for sustainable production and consumption”. Implementation was mainly foreseen via National Biodiversity Strategy and Action Plans (NBSAPs). However, how to address those “underlying causes” was unclear, by failing to describe how to connect policy targets to the production and consumption patterns, and hence only 13 per cent of signatories achieved the stated target.

Ambitious targets are not enough. They must also be measurable, monitored, and

supported by credible science-based strategies for action, including policy and investment. Monitoring them must also create sufficient credible transparency to expose inaction of vested interests, acting as the starting point for dialogue on the challenges of transition.

To achieve this, a multilateral governance framework for better management of the drivers of biodiversity decline is required. We need to understand how to translate global targets into monitored and globally reported national strategies that manage natural resources. To begin halting, then reversing, the damage to nature across all aspects of the economy, implementation mechanisms must bring together policymakers across government and sectors.

“Unless we can come up with a target that addresses the drivers of biodiversity loss, we need to tread carefully”

Elizabeth Mrema, CBD Chief, speaking to Nature Magazine

©Photo: Derek Oyen / Unsplash



©Photo: Steven Lasry / Unsplash



©Photo: Sebastian Pena Lambarri / Unsplash



©Photo: Pexels / Unsplash



3.

TO ADDRESS THE DRIVERS OF BIODIVERSITY DECLINE, WE MUST TAKE A NATURAL RESOURCE MANAGEMENT APPROACH.

Natural resources and resource management approaches have, up until now, been the missing link in policymaking that has struggled to incentivize transformational change. Taking such an approach can put leaders of biodiverse-rich nations at the forefront of global innovation in natural resource use and the circular bioeconomy, and all leaders on a path towards achieving circularity, climate and sustainability objectives.

We need to use natural capital in decision-making and incorporate externalities in the prices of goods and services to address distorted economic systems. We must change how industries, governments and societies are incentivized to produce and consume the things that come from our natural environment – including land, water, biomass, metals, minerals and fossil fuels.

These natural resources are at the centre of the Sustainable Development Goals and the 2030 Agenda for Sustainable Development. They underpin human consumption and production systems and are intertwined with

climate, biodiversity and pollution/health. Yet the way we extract, process, use and dispose of natural resources devastates global biodiversity. The global solution is an approach to natural resources that leverages the full, complex value of biodiversity and manages it in an integrated manner alongside other societal needs. The good news is that this approach is also a win-win for the climate and social justice agendas.

Natural resource management means treating the illness, not only the symptoms of biodiversity loss. Understanding the specific drivers of biodiversity loss is the first step to incentivize effective responses by producers and consumers through social, economic, and environmental policy. Land conservation policies alone will not reverse the trends we see today. We need to focus on the choices that industries, governments and societies make about how we produce and then consume the things that come from our natural environment. We must link consumption and production, through the

flow of natural resources along supply chains and borders, to the environmental impacts. Then we must make changes all along that value chain: primary producers, processors, retailers and customers must all be incentivized towards understanding and reducing their planetary footprint.

A good example is biodiversity loss due to deforestation driven by shifting agricultural and commodity supply chains (Curtis 2018). Between 2001 and 2015, 315 million hectares of global forests were lost, 77 per cent of which was due to permanent land use change driven by a combination of commodity production, agricultural shift and forestry (Curtis 2018)². This land use change took place across millions of hectares in the tropics and reflects the greater reliance of countries at early stages of development on biomass-based materials and energy for their development (IRP 2019a). It would be unfeasible to try to place all that land aside for conservation. Instead, we can look to address the underlying drivers, not just biomass demand, but also the social and economic conditions, that cause it to be harvested in an unsustainable way. By applying the principles of natural resource management to policy and business development it becomes possible to create more targeted solutions all along the value chain that aim to fulfil that demand while also halting deforestation.

Critically, in doing so we address the same drivers that are responsible for climate change and environmental pollution, and create multiple “co-benefits” for other

Sustainable Development Goals. Restoring biodiversity results in direct and indirect contributions to improving local air quality, better soil fertility, wastewater treatment, water security, local livelihoods and tourism as a source of sustainable economic development (IPBES 2018). For example, sharing knowledge of agro-ecological practices to use the right plot of land and planting diverse crops could reduce the need for fertilizer use (thereby reducing climate impacts) and increase crop resilience for improved food security.

Natural resource management enables us to draw a direct link between environmental outcomes and market signals. Market signals play a role in driving the behaviour of producers and consumers. We cannot send signals which reward unlimited private exploitation of natural resources while attempting to protect public interest in nature through regulation and public funding for conservation. This mixing of signals creates confusion, bad will in partnerships, and incentivizes lobbying. Instead, we must use natural resource management to create positive market signals which incentivize the transparent, circular and regenerative use of natural resources, aligning public and private interests. We need the markets to reflect that how we treat natural resources not only impacts the environment, but also determines economic success.

2. While deforestation continues rapidly, afforestation is also taking place at scale around the world, including in some tropical regions. However, it will take a very long time for forest regeneration projects to reach the level of biodiversity richness supported by standing old-growth forests.



Figure 2: Natural resources underpin human consumption and production systems and are intertwined with climate, biodiversity and pollution/health.



4.

FOUR PRINCIPLES OF NATURAL RESOURCE MANAGEMENT CAN HELP COUNTRIES EFFECTIVELY IMPLEMENT BIODIVERSITY POLICY.

Policymakers responsible for all aspects of society can assist biodiversity recovery by designing policies around four principles of natural resource management to develop targeted solutions for the drivers of biodiversity loss. A strong foundation of each principle is inclusive and open engagement with stakeholders at all levels, a clear reliance on scientific and indigenous knowledge, and the highest level of political support to overcome vested interests for the best social and ecological outcomes.

Supported by the research of the International Resource Panel and other critical assessment processes such as those guided by the Intergovernmental Panel on Climate Change (IPCC), IPBES, the Convention on Biological Diversity (2020), and UNEP (2019, 2021b), these evidence-based principles show how policymakers

can work together with actors along the value chain and across sectors to ensure that our provisioning systems are designed to protect biodiversity and reduce waste. Transparency of resource use, integrated planning, biodiversity-positive economic policy measures and an understanding of the value of nature to humanity can together transform our relationship with nature.



©Flickr photo



©Photo: UN Photo/Kibae Park

NATURAL RESOURCE MANAGEMENT PRINCIPLES FOR BIODIVERSITY



Know your true impact

Value-chain transparency

How to apply them

A science-based, participatory value-chain approach based on material flow and impact-footprint data provides transparency on biodiversity use and impacts across sectors and lifecycles. This transparency can be used to design policies that incentivize demand for resource-efficient, low-footprint products.

Benefits to biodiversity

Enables identification of, and action to correct biodiversity loss drivers up and down the value chain, including biomass consumption and production.

Mutual advantage for social equity & climate

Value chains which no longer incentivize depletion of biodiversity also benefit build-up of natural carbon sinks and protect the ecosystem services upon which many rely for income and resilience.



Plan together

Integrated landscape planning

How to apply them

Integrated spatial landscape planning assesses natural resource demand across ministries, sectors and stakeholders, and with high level political support, optimizes integrated policymaking for biodiversity governance.

Benefits to biodiversity

Protects biodiversity by ensuring that overlapping uses of ocean and land natural resources do not collectively deplete ecosystems. Supports the mainstreaming of biodiversity priorities across sectors and ministries.

Mutual advantage for social equity & climate

Optimizing use of land and oceans integrated for all policy objectives will ensure best land-use for climate needs, alongside biodiversity, socio-economic and infrastructure needs.



Grow with nature

Nature-based and circular solutions

How to apply them

Design economic, urban, agricultural and other policies to incentivize nature-based solutions and transitioning to a circular bioeconomy that leverages natural ecosystem services while halting and reversing biodiversity loss.

Benefits to biodiversity

Halts and reverses biodiversity loss by eradicating practices which drive ecosystem degradation – such as excess fertilizer use and food loss – and supporting practices that regenerate them.

Mutual advantage for social equity & climate

Nature based agricultural methods reduce GHG emissions and create carbon sinks; while nature-based urban planning can decrease pollution and increase health outcomes.



Value nature

Recognize nature's benefits

How to apply them

Recognize and account for the role nature plays in our world and enable the economic system to recognize nature's benefits, to allow investment, e.g. payments for ecosystem services. Governance of natural capital valuation requires clear international standards, and careful regulation.

Benefits to biodiversity

Enables the private sector, communities and individuals to value nature, and to be valued for protecting nature, incentivizing conservation and innovation for better regeneration.

Mutual advantage for social equity & climate

Protecting forests means securing one of Earth's most important carbon stocks, as well as the source of livelihood for billions on the planet.

KNOW YOUR TRUE IMPACT The principle of value-chain transparency

Designing effective biodiversity policy means being clear and consistent on impacts. Often, nations pledge to reduce their biodiversity impacts without fully understanding where and how the damage is taking place. For example, many countries import meat which is indirectly driving deforestation or water pollution through the rapid expansion of agricultural landscapes.

Countries must identify key points of intervention within economic systems to reduce natural resource use and environmental impacts caused by production and consumption, and to define a common agenda for action (UNEP 2021b). This means a transparent value-chain approach.

In concrete terms we must understand the best points along the value chain to incentivize investments and shift demand. What trends support business models which drive biodiversity mismanagement? What

practices, from production to consumption through the value chain, are currently contributing to its destruction?

This can be done by tracing materials such as biomass through value chains – that is, all stages of a product’s life – which benefit from or deplete biodiversity. In technical terms, “footprint accounting” demonstrates the production-related impacts of consumer demand based on natural resource flows.

This gives producers, consumers, and investors along the value chain the transparency to prioritize sustainable models. Getting the level of detail needed to guide strategic decision-making has been methodologically challenging, but new scientific methods mean that this type of accounting can now enable strategic decision-making (Cabernard 2019) (while further international efforts and investments are needed to refine and standardize the relevant scientific tools).

Transparency leads to accountability, making it more difficult for consumers and producers to reject shared responsibility for biodiversity loss. It can also, importantly, show where positive gains are being made along the value chain, by raising the profiles of sustainable production and consumption models with low biodiversity impact. By better understanding what products and services drive regeneration up the value chain, and providing the metrics for investment, policymakers can create an impetus for “indirect” but powerful financial investment in biodiversity-positive business models and technological innovation.

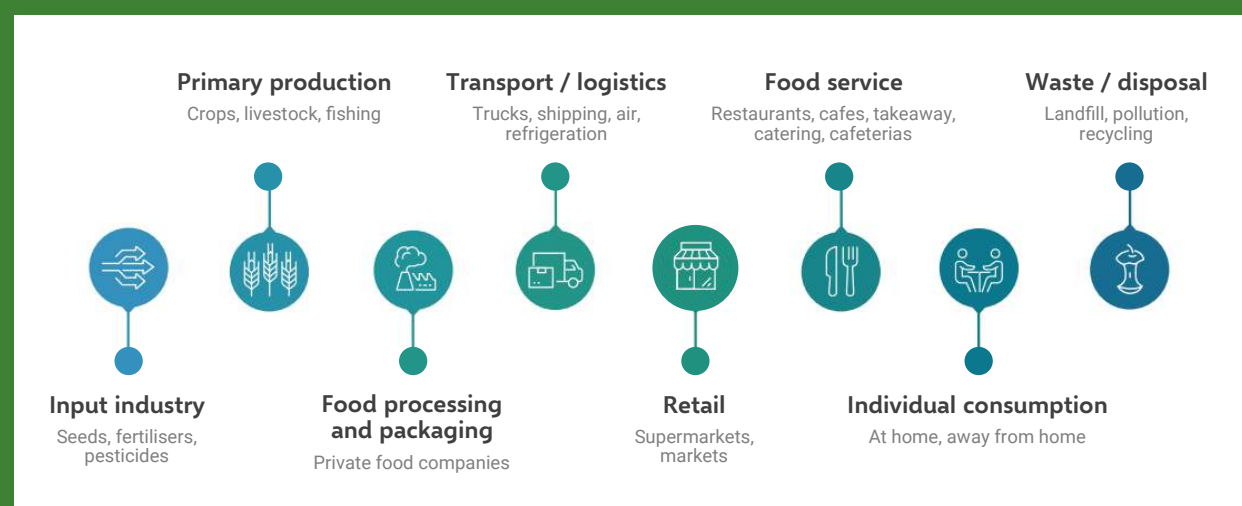
Transparency requires good data. Policymakers can design policies that support standardization of supply and value-chain data and support research into technologies that enable such transparency. Creating standardized systems for gathering data and making it publicly available will help. For example, producers and traders of forest products will not be incentivized to invest in traceability if every importing country uses its own standards to count impacts and material flows. The current zero-draft of the post-2020 framework for biodiversity recognizes this. It calls for the “sustainable management of transnational supply chains”. In our view, this means science-based, transparent value chains, backed by good data and consistent international standards.

Box 2 **The IRP can work with countries to provide data and methods to assess their value chains.**

While globalization promotes an increasingly transnational use of natural resources, it is not sufficient for countries to apply national accounting metrics focusing solely on their direct natural resources use. For a true representation of resources and the associated impacts that contribute to economic activity, it is necessary to capture resource use across borders. Transboundary footprints are a critical tool in a systems and value-chain approach, measuring resource use, pollution emissions and many other pressures (IRP 2017).

The IRP’s Global Material Flows Database offers comprehensive insight into the connections between the world economy, population and material use, a critical decision-making tool for policy and business communities. This large data set comprising four decades of global materials extraction and materials trade provides direct and consumption-based material flow indicators for more than 185 countries, covering total usage, per capita use, material use per US dollar, and provides details for different groups of materials.

Figure 3: Simplified overview of the stages of a food value chain (UNEP 2021a).



©Photo: Diana Parkhouse, England / Unsplash

Case Study 1

Technology improves transparency

Many producers could take the lead on value-chain transparency by investing in technology that traces the origin of their raw goods. This will enable them to understand their impacts beyond the factory floor. Cocoa farming is a critical industry in much of the world's tropical belt, and often is situated in the leafy shade at the periphery of tropical forests. As demand for chocolate grows, cocoa plantations expand, often driving deforestation. Increasingly, chocolate producers are recognizing the link between their product and the impacts on the ground, such as soil degradation and deforestation. One such producer, Barry Callebaut, is using satellite services to trace the direct and indirect supplies of cocoa to its supply chain in order to remove deforestation drivers (Callebaut.com). Demand for technological solutions such as this will continue to grow.



©Photo: Alexandre Brondino / Unsplash

Case Study 2

Transparency drives investment

Countries that support a robust and transparent system for tracing value chains will increasingly have better access to finance. At the behest of clients, investment portfolios are taking increasing interest in biodiversity, but have found it difficult to invest directly (Tasman-Jones 2019) because the positive impacts that investors are asking for is difficult to measure. An online platform being developed by the Zoological Society of London and used by first-mover fund managers offers one solution. It details the activities of soft commodity producers which enables proactive investors to avoid companies that are not managing their externalities, or to identify specific natural resource management strategies that improve upon how biodiversity and deforestation are managed (Tasman-Jones 2019). Policy-support for the standardization of supply chain data would further support such initiatives.



©Photo: Ales Krivec / Unsplash

Case Study 3

Governments drive value-chain transparency

In 2021 the German Federal Government intends to pass a supply chain act that will require companies to meet minimum standards of due diligence in supply chain³ practices, particularly with regards to human rights and environmental impacts. This has wide support from businesses and environmental campaigners alike, who note that outside Europe it is difficult to control what happens outside of Europe's borders, and that regulatory support will contribute to a level playing field (Askew 2020).

³. Supply chains are a component of the overall value chain of a product, specifically the process of production and distribution of a product to a consumer.



©Photo: Fredrik Öhlander, Vallvik, Sweden / Unsplash

PLAN TOGETHER

The principle of integrated landscape planning

Natural resources are over-stretched and over-exploited because countries have an incomplete picture of how they are being used and how those uses impact each other. For example, a forest which provides water retention and protection through its catchment for a nearby city may also be a source of income for a community reliant on a local timber mill. Often, no integrated strategy exists to balance those conflicting demands. Integrated landscape plans enable national and local governments to consider the optimal use of land and oceans by using spatial mapping to match land use with its sustainable potential, and to quickly identify areas within the landscape that have high value for multiple uses (pressure points) and where conversion to a particular use precludes both current and future uses (high opportunity costs).

For example, early identification of biodiversity hotspots and productive

agricultural land that are in the “path of least resistance” for housing, transportation and industrial development can provide help to focus attention on those areas where land use decisions will have the greatest impact. Similarly, this approach allows stakeholders to consider alternatives that may result in multiple benefits from the same piece of land. A good example of both is agricultural landscapes where stream and river margins have been reserved for biodiversity conservation and sediment and nutrient filtering, and the adjacent deep soils are devoted to intensive crop production. Intensifying crop production on the highly productive parts of the landscape can allow the remainder (often areas with steeper slopes) to be used for less intensive production systems, such as perennial native pastures, that provide protein, wildlife habitat and carbon sequestration, while conserving soil. These areas with lower



©Photo: Thomas Richter / Unsplash



©Photo: Maria Krasnova, Tokyo, Japan / Unsplash



Figure 4: Five main elements of integrated land management.



potential for biodiversity conservation and agricultural production can also be used for human habitation and infrastructure .

Integrated landscape plans make it easier for stakeholders to devise solutions for the sustainable use of land and oceans. But this can only be achieved when everyone is brought to the table, across all relevant ministries, industries and stakeholder groups and bolstered by the highest levels of political support. Laying out demands together makes it easier to strategically consider stakeholders’ needs against the land and water resources available, for optimal use and minimal trade-offs. Sometimes that will mean finding a better balance between conservation and extraction of resources; in other cases, it will highlight win-wins – for example, when marine protected areas increase local fish populations and encourage sustainable tourism. The need for coherence in spatial planning is also highlighted by the OECD (OECD 2020).

There are five main elements to the process of integrated land management: stakeholder engagement, matching land use with its sustainable potential, collaborative development of a vision and action plan, implementation, and tracking changes. An analysis developed by the International Resource Panel examined over 350 of these initiatives. It found a large proportion reported positive impacts across agriculture, ecosystems, livelihoods and institutions (IRP 2019b). Those positive impacts are reflected in smaller impact footprints, providing even further opportunities for investment and positive uptake from consumers.

In a resource-constrained world, it is easy to think only in terms of resource competition. Planning together not only works towards greater resource efficiency; it is the lens through which to see the cross-benefits for global health, climate resilience, sustainable prosperity and social equity.



Case Study 4

National land use mapping to reduce conflict

One example is Indonesia's foresighted OneMap Initiative (WRI). Land ownership disputes in Indonesia are contributing to accelerated biodiversity loss. Records are often incomplete or inconsistent. Indigenous communities, and others who have traditionally held land in common, see their territory claimed by palm oil producers or extractive industries. Government agencies have been known to grant competing companies rights to operate in overlapping jurisdictions – the exact opposite of the “plan together” principle. To address these problems and enable the protection of forests and other high-biodiversity biomes, the government's One Map project aims to reduce conflict, clarify land rights, and therefore manage Indonesia's great natural resources more sustainably by mapping land use across the nation (WRI). Whether it is ultimately successful in the long term will depend in large part on local community involvement.



Case Study 5

Inclusive landscape action plans for optimum efficiency

An example of integrated land management can be found on the Caribbean coast of Honduras. The Solidaridad Network is facilitating the Paisajes Sostenibles (Sustainable Landscapes – PaSos) initiative. The landscape has very high-value forest and coastal biodiversity, but also rapidly expanding agricultural production and a growing population, and has experienced extensive degradation of soil, forest, water and biodiversity. PaSos brought together a diverse range of landscape stakeholders. Together they shared their understanding of the landscape, and defined a set of ambitions concerning production, environment and human well-being for the landscape in 2030. They are now creating, and committing to, a landscape action plan which meets food security, biodiversity, water and climate change targets (IRP 2019b). In this way the landscape is managed for optimum efficiency, minimizing the ecological footprint of any export products – something that could, in the future, be highlighted to consumers through a transparent value chain.



Case Study 6

Intelligent eco-zoning to delineate conservation areas

Another application of integrated landscape planning is intelligent eco-zoning based on ecological, social and economic data, as well as local knowledge. This is the approach taken in China, which for the past 10 years has been developing the Ecological Conservation Red Line (Jixi 2019). When reflecting on the causes of the devastating Yangtze flood of 1998, China recognized the flood severity was an effect of ecological degradation. This triggered an initiative to develop technologies and scientific methods to assess areas for their biodiversity richness and their ecosystem services such as freshwater protection, and resilience to natural disasters. Those areas are protected by national mandates within the context of local industrialization and urbanization. Buy-in from local authorities has been essential for the successful implementation of the scheme. Currently, an area greater than France, Spain, Turkey, Germany and Italy combined is earmarked for protection thanks to its ecological value.



GROW WITH NATURE The principle of nature-based solutions

As the world has increasingly relied on technology and mechanization to support booming food and material production, we have moved away from sustainable methods of producing biomass goods. That has led in particular to global decline in natural landscapes: pesticide use has decimated insect populations, fertilizer use and wastewater leakage is resulting in waterway algal blooms, and modern tilling techniques are lowering soil quality. These practices degrade rather than regenerate natural resources; they are consequently primary drivers of biodiversity loss (WWF 2018).

We can address unsustainable production of biomass by going back to what nature teaches us. In policy terms, that means supporting nature-based solutions by incentivizing a circular bioeconomy – one that leverages natural ecosystem services while slowing biodiversity decline. By our definition, nature-based solutions do not include all methods of biomass production, only those that aim to replicate nature's ecosystem services to create sustainable and low-impact solutions. Mono-crop production and large-scale mono-culture afforestation, for example, have negative effects for biodiversity and water security. Instead, in agricultural production, working with nature could mean integrating pest and nutrient management to reduce the need for fertilizers and pesticides, and creating greater impetus for organic farming (UNEP 2021b). Of course, nature-based solutions do not only have advantages for sustainable

agriculture. An example for water protection is relying on pristine landscapes to naturally filter drinking water to reduce the need for chemical treatment, as New York City does (Hu 2018). While the principles above focus on re-shaping demand and resource use, this principle focuses on the inherent capacity of the natural environment to provide and to regenerate.

Nature-based practices can, if carefully considered, reduce the impacts of biomass production by leveraging the advantages of a sustainable bioeconomy that does not deplete natural capital over time, helping soil, land, water and vegetation maintain healthy life cycles. These practices start with avoiding ecosystem degradation, including minimizing any wasteful processes in the bioeconomy, and come full circle by assisting the recovery of ecosystem functions (IRP 2019b). This is the circular bioeconomy. Examples include sustainable urban planning, nutrient recycling, no-till agriculture, fishing below maximum sustainable yields and from low-trophic species, and improved forestry practices which reduce clear-cutting (IRP 2016). It also includes strategies that reduce food loss and waste, before and after the farm gate, such as timing of crop harvesting and better cool storage systems.



©Photo: Yoel Winkler, Ada, Ghana / Unsplash

Case Study 7

Regenerative bioeconomy for poverty eradication

One example of the regenerative bioeconomy is the planting of bamboo to support poverty alleviation, enhancing land vitality and supplementing local incomes. The IRP Land Restoration for Achieving the Sustainable Development Goals report (2019) described examples from China, Ethiopia, Cameroon, Viet Nam, India, Madagascar, Ghana, the Philippines and Kenya, of successfully using bamboo for land restoration: planting bamboo re-greens degraded landscapes while supporting local economies via jobs and additional income. In Tanzania over 1,000 jobs were created alongside additional income for each local household (FAO 2018).



©Photo: Kemiri Sunan tree (Reutealis trisperma) Wikimedia commons

Case Study 8

Regenerative bioeconomy for biodiversity protection

A regenerative bioeconomy can also protect standing forests from further encroachment. The Kemiri Sunan tree project is a regenerative business development in Indonesia. The Kemiri Sunan tree (*Reutealis trisperma*) grows on dry and degraded land, such as former logging, mining and palm oil concessions, and restores the chemical and physical properties of depleted soils which would not recover through natural regenerative processes (Food and Land Use Coalition [FOLU] 2019). The tree produces oil extracted from seed kernels which can be processed into a high-quality, efficient biofuel, while also restoring soil conditions for forest regeneration. The oil yield per hectare is the highest of any vegetable oil (Republic of Indonesia, Ministry of Environment and Forests 2018) – more than double that of palm oil produced for biodiesel purposes. This enables a community to actively restore soils while also making a living – and being supported by the Indonesian government, which is putting in place strong regulatory land use policies for ecosystem restoration. A 30,000ha plantation on degraded land in Indonesia is in the early stages of development and could provide a good low opportunity cost model for biofuels supply during the decarbonization transitions phase (FOLU 2019).

VALUE NATURE The principle of recognizing nature's benefits

Nature has significant intrinsic value and provides ecosystem services which are not recognized by our economic system, for example key regulating services. Many argue that we should not attempt to put a price on nature. But if our economic system ignores the natural services that maintain it, it will not survive, and nor will any of us. We must incentivize long-term investment in nature. This is not an altruistic action: the International Labour Organization estimates that nature-based solutions have a job creation rate 10 times larger than that of fossil fuel investments (WBCSD 2021).

We invest better in nature by accounting for the role it plays in how we produce and consume goods. The 2021 Dasgupta Review recommends that we begin by measuring economic success using an inclusive measure of wealth – one that includes

human, produced and natural capital assets. This makes it easier to establish tools such as payments for ecosystem services, or governmental subsidy payments to farmers for improved environmental outcomes. Coupled with transparent regulatory action, this is critical in order to eliminate perverse agricultural, fossil fuel, fisheries, mining and transportation subsidies which encourage firms to externalize costs to nature which are then borne by society (UNEP 2021b).

Finding ways to value the services of nature will allow biodiverse-rich nations and indigenous communities to benefit from their role in protecting Earth's most biodiverse regions and allow importing countries to improve supply chain resilience. One aspect of this is for investment funding to begin prioritizing the green, circular bioeconomy.



©Photo: Filip Urban / Unsplash



©Photo: Helena Lopes / Unsplash

Case Study 9

Policy measures for ecosystem valuation

While instruments to value ecosystem services are still rare, there are increasing examples of policy instruments which aim to conserve forestry and environmental assets – and developmental projects being designed to take positive advantage of them. Regulated instruments include Payment for Ecosystem Services, REDD+, and carbon credits.

One initiative which hopes to stimulate its region's environmental assets via such financial compensation instruments is the Araguaia League. Located in the state of Mato Grosso, Brazil, the Araguaia League is a pioneering initiative which focuses on rural development. Its objective is to improve sustainable intensification of the cattle market, centred around pillars of productivity, conservation, emissions reduction and tourism. Practically this means recovery of degraded pastures and the adoption of good agricultural practices, ultimately to create a sustainable bioeconomy that is more in harmony with its local environment (Liga do Araguaia).

5.

MAKE TARGETS BOLD AND IMPLEMENTABLE THROUGH A NATURAL RESOURCE MANAGEMENT APPROACH TO HELP KUNMING SUCCEED.

Looking back, 10 years ago we left Nagoya with a sense of achievement, having secured a broad and ambitious multilateral agreement on biodiversity – the first of its kind. However, that agreement did not have a clear strategy for implementation. As a result, Aichi did not trigger the real action we had hoped for; it failed to lay out implementable strategies to target the natural resource use drivers of biodiversity loss and tackle entrenched systems head-on.

That is why the biggest opportunity in Kunming in 2021 is to embed natural resource management approaches and principles into the target-making and the implementation mechanism of the agreement. In doing so, it will be critical that goals, targets and, most importantly, actions are harmonized.

There are four actions of leadership that could turn the tide towards a successful post-2020 global biodiversity framework of the CBD.



©Photo: Chor Sokunthea, World Bank / Flickr



©Photo: Thien Kim Nguyen Trinh / Unsplash

1.

Adopt bold biodiversity targets based on natural resource management approaches to address the drivers of biodiversity loss.

We call on countries to use natural resource management approaches to acknowledge, understand and address the direct and indirect drivers of biodiversity loss for climate, nature and socially just economic and social development.

The current zero-draft text of the post-2020 framework acknowledges the need for “efforts to reduce drivers of biodiversity loss”. It adopts a bold target in calling for countries to “reform economic sectors towards sustainable practices, including along their national and transnational supply

chains, achieving by 2030 a reduction of at least 50 per cent in negative impacts on biodiversity”. What is missing is a clear link to the world’s biggest direct and indirect drivers of biodiversity loss – the inefficient production and use of biomass to provision societies. This statement stops short of calling for science-based indicators which deliver full transparency of biodiversity impact through value chains; something that is becoming possible with the right international commitment to standardizing such indicators (Cabernard 2019).

An effective framework must focus the world’s efforts by being clearer about which drivers are most important to tackle – not just for biodiversity but for climate and socio-economic development. In order to shift the focus of global biodiversity governance to drivers of biodiversity loss, we need to focus on the choices that industries, governments and societies make about how we produce and then consume the things that come from our natural environment. In turn such insight could facilitate the transformation of how economic and financial sectors approach and invest in natural capital. Taking a natural resource management approach can help to identify the optimal action areas for policymakers to halt and reverse biodiversity loss.

2.

Embed the principles of natural resource management into implementation mechanisms in the post-2020 framework.

Not only must countries adopt bold targets, they must follow them up with equally ambitious and rigorous implementation strategies. It is important for policy-setting leaders at the CDB negotiations to use natural resource management principles to make the text as strong as possible on guiding implementation.

While the draft text currently refers to incorporating the biodiversity framework in national and local planning and across all sectors of society, it could go further to explicitly anchor a common approach to effective implementation of the targets. Implementation mechanisms must bring together through the highest levels of political support policymakers across government including from finance, agriculture, transportation, fishery and environmental ministries. Referring to value-chain transparency and integrated landscape planning could provide a shared understanding of how to bring biodiversity and a natural resource management approach into mainstream thinking. Engaging with nature-based solutions for a circular bioeconomy incorporates biodiversity as a central component to sustainable economic development; and placing a value on those contributions enables further protection and reverence for the services provided by the natural world.



3.

Support transboundary partnerships for innovation and investment in regeneration.

Value-chain transparency, integrated landscape planning and valuation of natural capital are not only designed to improve accountability. All of the natural resource principles described here support countries seeking better innovation, investment and development strategies for biodiversity-positive socio-economic development.

Countries already achieving success in implementing biodiversity policies must make the most of the attention around Kunming in 2021. This is the chance to showcase their “best in class” strategies which address biodiversity loss through natural resource management principles, and demonstrate the innovative approaches needed to take the Kunming targets from paper to practice.

The post-2020 biodiversity framework must also support this exchange of information and capacities, and serve as the platform to

trigger transboundary and sector-wide partnerships towards the stated targets. This includes engaging with stakeholders and the private sector – for which the biodiversity agenda is growing in importance.

Implementation of the post-2020 global biodiversity framework could incorporate a platform that strategically funnels investment into industries; it should focus on those industries that most need – and can best apply – a more transparent and nature-based approach to their biodiversity impact and their ecosystem services needs. By building systems that give policymakers, stakeholders and investors transparent access to scientific data and investment opportunities, we enable them to commit to new projects at greater scale, potentially opening significant economic and social opportunities for biodiversity-rich regions and those that rely on them.

4.

Strengthen multilateral cooperation for better governance of natural resources.

While resource management principles to nurture biodiversity can be implemented locally and nationally, international multilateral governance must play a role. For example, it will take multilateral cooperation to establish a global system of standardized, science-based data-sharing to build transparent value chains. Reliable, trusted information is paramount for the policy and investment decisions needed to better manage our natural resources.

We need to connect biodiversity governance to natural resource governance. A global forum which gathers groups mandated to manage the drivers of biodiversity loss across industry, finance, agriculture, environment, economics and major groups, could facilitate productive, solution-oriented discussion in order to truly “mainstream” biodiversity. Here we could germinate biodiversity-recovery policies from which all ultimately benefit.

“

We support ambitious leaders in Kunming who would call for starting formal discussions on the governance of natural resources including at forums such as the UN Environment Assembly, the High Level Political Forum or in the UN General Assembly.”

Janez Potočnik and Izabella Teixeira,
Co-Chairs of the International
Resource Panel

Biodiversity governance must become fundamental to our redesign of natural resource use, to its drivers and its economic incentives.

Natural resources are the bridge between economy and competitiveness on one hand and climate change, biodiversity loss, pollution and global health on the other. Natural resource management approaches have been the missing link in policymaking which has taken too long to trigger transformational change.

The International Resource Panel stands ready to help, alongside the biodiversity governance and scientific community, to provide the scientific insights needed to implement effective biodiversity governance.

Let us begin in Kunming.

Janez Potočnik and Izabella Teixeira
Co-Chairs of the International Resource Panel



REFERENCES

Askew, K. (2020). Germany taking lead in support of EU sustainable procurement: "We need a supply chain law... Preferably yesterday". Food Navigator, 14 August. <https://www.foodnavigator.com/Article/2020/08/14/Germany-taking-lead-in-support-of-EU-sustainable-procurement-We-need-a-supply-chain-law-Preferably-yesterday>

Barry Callebaut. The professionalization of cocoa farming. <https://www.barry-callebaut.com/en/manufacturers/sustainability-in-action/cocoa-brazil>. Accessed January 2021.

Cabernard, L., Pfister, S. and Hellweg, S. (2019). A new method for analysing sustainability performance of global supply chains and its application to material resources. *Science of the Total Environment*, 684, 20 September, 164-177. <https://doi.org/10.1016/j.scitotenv.2019.04.434>.

Curtis, P.G., Slay, C.M., Harris, N.L., Tyukavina, A. and Hansen, M.C. (2018). Classifying Drivers of Global Forest Loss. *Science*, 361(6407), 1108–11. <https://science.sciencemag.org/content/361/6407/1108/tab-figures-data>

Dasgupta, P. (2021). *The Economics of Biodiversity: The Dasgupta Review*. London: HM Treasury.

Food and Agriculture Organization of the United Nations (2018). *Why Bees Matter: The importance of bees and other pollinators for food and agriculture*. <http://www.fao.org/3/i9527en/i9527en.pdf>

Food and Agriculture Organization of the United Nations and INBAR (2018). *Bamboo for land restoration*. INBAR Policy Synthesis Report 4. Beijing. <https://www.inbar.int/wp-content/uploads/2020/05/1528867712.pdf>

Food and Land Use Coalition (2019). *Prosperous Forests*. London. https://www.foodandlandusecoalition.org/wp-content/uploads/2019/11/FOLU-Prosperous-Forests_v6.pdf

Global Commission on Adaptation (2019). *Adapt Now : A Global Call for Leadership on Climate Resilience*. Washington, DC: World Resources Institute. Global Commission on Adaptation. <https://openknowledge.worldbank.org/handle/10986/32362> License: CC BY 4.0 International

Hu, Winnie (2018). *A Billion-Dollar Investment in New York's Water*. New York: New York Times, 18 January.

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019a).

Nature's dangerous decline "unprecedented", species extinction rates "accelerating". *ScienceDaily*, 6 May. Retrieved 22 March 2021 from www.sciencedaily.com/releases/2019/05/190506093610.htm

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2018). *The IPBES assessment report on land degradation and restoration*. Montanarella, L., Scholes, R., and Brainich, A. (eds.). Bonn. 744. <https://doi.org/10.5281/zenodo.3237392>

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019b). *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. https://www.ipbes.net/sites/default/files/ipbes_7_10_add.1_en.1.pdf

International Research Panel and United Nations Environment Programme (2016). *Food Systems and Natural Resources. A Report of the Working Group on Food Systems of the International Resource Panel*. Westhoek, H., Ingram J., Van Berkum, S., Özay, L., and Hajer, M. <https://www.resourcepanel.org/reports/food-systems-and-natural-resources>

International Resource Panel (2017). *Assessing global resource use: A systems approach to resource efficiency and pollution reduction*. Bringezu, S., Ramaswami, A., Schandl, H., O'Brien, M., Pelton, R., Acquatella, J., Ayuk, E., Chiu, A., Flanegin, R., Fry, J., Giljum, S., Hashimoto, S., Hellweg, S., Hosking, K., Hu, Y., Lenzen, M., Lieber, M., Lutter, S., Miatto, A., Singh Nagpure, A., Obersteiner, M., van Oers, L., Pfister, S., Pichler, P., Russell, A., Spini, L., Tanikawa, H., van der Voet, E., Weisz, H., West, J., Wijkman, A., Zhu, B., Zivy, R. Nairobi: United Nations Environment Programme. <https://www.resourcepanel.org/reports/assessing-global-resource-use>

International Resource Panel (2019a). *Global Resources Outlook 2019: Natural Resources for the Future We Want*. Oberle, B., Bringezu, S., Hatfeld-Dodds, S., Hellweg, S., Schandl, H., Clement, J., Cabernard, L., Che, N., Chen, D., Droz-Georget, H., Ekins, P., Fischer-Kowalski, M., Flörke, M., Frank, S., Froemelt, A., Geschke, A., Haupt, M., Havlik, P., Hüfner, R., Lenzen, M., Lieber, M., Liu, B., Lu, Y., Lutter, S., Mehr, J., Miatto, A., Newth, D., Oberschelp, C., Obersteiner, M., Pfister, S., Piccoli, E., Schaldach, R., Schüngel, J.,

Sonderegger, T., Sudheshwar, A., Tanikawa, H., van Der Voet, E., Walker, C., West, J., Wang, Z., Zhu, B. Nairobi: United Nations Environment Programme. <https://wedocs.unep.org/handle/20.500.11822/27519>.

International Resource Panel (2019b). *Land Restoration for Achieving the Sustainable Development Goals: An International Resource Panel Think Piece*. Herrick, J.E., Abrahamse, T., Abhilash, P.C., Ali, S.H., Alvarez-Torres, P., Barau, A.S., Branquinho, C., Chhatre, A., Chotte, J.L., Cowie, A.L., Davis, K.F., Edrisi, S.A., Fennessy, M.S., Fletcher, S., Flores-Díaz, A.C., Franco, I.B., Ganguli, A.C., Ifejika Speranza, C., Kamar, M.J., Kaudia, A.A., Kimiti, D.W., Luz, A.C., Matos, P., Metternicht, G., Neff, J., Nunes, A., Olaniyi, A.O., Pinho, P., Primmer, E., Quandt, A., Sarkar, P., Scherr, S.J., Singh, A., Sudoi, V., von Maltitz, G.P., Wertz, L., Zeleke, G. Nairobi: United Nations Environment Programme.

International Resource Panel. *Global Material Flows Database*. <https://www.resourcepanel.org/global-material-flows-database> [Accessed January 2021]

International Union for Conservation of Nature. *Nature-based Solutions*. <https://www.iucn.org/commissions/commission-ecosystem-management/our-work/nature-based-solutions>. Accessed 23 March 2021.

Jixi, G. (2019). How China will protect one-quarter of its land. *Nature*, 569(457). doi: <https://doi.org/10.1038/d41586-019-01563-2>

Kempf, I. (2018). *Poverty and the environment/climate change*. UNDP-UNEP Poverty-Environment Initiative. <https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2018/05/9.pdf>

Liga do Araguaia. *The Araguaia League*. <https://www.ligadoaraguaia.com.br/the-araguaia-league/> Accessed January 2021

OECD. (2020). *Towards Sustainable Land Use Aligning Biodiversity, Climate and Food Policies*. OECD Publishing. https://www.oecd-ilibrary.org/sites/3809b6a1-en/1/1/1/index.html?itemId=/content/publication/3809b6a1-en&csp_=5db648acc373bad6d1abd3dc5e769aca&emlGO=oe&itemContentType=book

Rea, A. W., and Munns, W. R., Jr (2017). The value of nature: Economic, intrinsic, or both? *Integrated environmental assessment and management*, 13(5), 953–955. <https://doi.org/10.1002/ieam.1924>

Republic of Indonesia, Ministry of Environment and Forests (2018). *The State of Indonesia's Forests*

Secretariat of the Convention on Biological Diversity (2020). *Global Biodiversity Outlook 5*. Montreal. <https://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf>

Tasman-Jones, J. (2019). *Biodiversity Struggles to Achieve Momentum of Climate Funds*. Portfolio Adviser, 15 August 20, <https://portfolio-adviser.com/biodiversity-struggles-to-achieve-momentum-of-climate-funds/>

United Nations Environment Programme (2021a). *Catalysing Science-based Policy action on Sustainable Consumption and Production: The value-chain approach & its application to food, construction and textiles*. Nairobi. <https://www.resourcepanel.org/reports/catalysing-science-based-policy-action-sustainable-consumption-and-production>

United Nations Environment Programme (2021b). *Making Peace with Nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies*. Nairobi. <https://www.unep.org/resources/making-peace-nature>

Van Engelsdorp, D., Hayes, J. Jr, Underwood, R.M., Pettis, J. (2008) A Survey of Honey Bee Colony Losses in the US, Fall 2007 to Spring 2008. *PLOS ONE* 3(12): e4071. <https://doi.org/10.1371/journal.pone.0004071>

World Business Council for Sustainable Development (2021). *The Economics of Biodiversity: The Dasgupta Review (2021) Summary brief for business*. <https://www.wbcsd.org/contentwbc/download/11278/166261/1>

World Resources Institute. *Understanding Indonesia's OneMap Initiative*. <https://www.wri.org/tags/understanding-indonesias-onemap-initiative>. [Accessed January 2021].

World Wide Fund for Nature (2018). *Living Planet Report 2018: Aiming Higher*. Grooten, M. and Almond, R.E.A. (eds). Gland, Switzerland.

World Wide Fund for Nature (2020). *Living Planet Report 2020: Bending the curve of biodiversity loss*. Almond, R.E.A., Grooten, M. and Petersen, T. (eds). Gland, Switzerland. https://www.wwf.fr/sites/default/files/doc-2020-09/20200910_Rapport_Living-Planet-Report-2020_ENGLISH_WWF-min.pdf

For more information, contact:
Secretariat of the International Resource Panel (IRP)
Economy Division
United Nations Environment Programme
1 rue Miollis - Building VII - 75015 Paris, France
Tel: +33 1 44 37 14 50 - Fax: +33 1 44 37 14 74
Email: unep-irpsecretariat@un.org
Website: www.internationalresourcepanel.org
Twitter: @UNEPIRP
LinkedIn: International Resource Panel (IRP)